UNIVERSITY OF PUNE

[4362]-155
S.E. (Electrical) Examination-2013
POWER SYSTEM-I
(2008 course)

Total No. of Questions: 12 **[Total No. of Printed Pages:6]**

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

(1) Answer three questions from each section.
(2) Answers to the two sections should be written in separate answer-books.
(3) Neat diagrams must be drawn wherever necessary.
(4) Figures to the right indicate full marks.
(5) Use of logarithmic table, slide rule, Mollier chart, electronic pocket calculator and steam tables is allowed.
(6) Assume suitable data if necessary.

SECTION I

Q.1) a. What are the advantages of interconnected operation of power generating stations? [06]

b. Define 'Tariff'. What are the objectives of tariff? [04]

c. The daily demands of three consumers are given below:

Time	Consumer 1	Consumer 2	Consumer 3
12 midnight to 8 am	No load	200 W	No load
8am to 2 pm	600 W	No load	200 W
2pm to 4 pm	200 W	1000 W	1200 W
4pm to 10pm	800 W	No load	No load
10pm to midnight	No load	200 W	200 W

Plot the load curve and find: [8]

1) Maximum demand of individual consumer.

2) Load factor of individual consumer.

3) Diversity factor.

OR

Q.2) a. Define the following factors associated with generating stations: [06]

i) Load factor.

ii) Diversity factor.

iii) Annual plant use factor.

b. Write a short note on H.T. and L.T. customers. [04]

c. The yearly load duration curve of a power plant is a straight line. [08]

The maximum load is 500 MW and the minimum load is 400 MW.

The capacity of the plant is 750MW.

Find, i) Plant capacity factor

ii) Load factor

iii) Utilization factor

iv) Reserve capacity

Q.3) a. Discuss the functions & principle of operation of atomic voltage regulator. [08]

Name different types of voltage regulators.

b. Define string efficiency. State different methods used for improving the string efficiency. Derive the expression for voltage distribution across the units of a string of suspension insulators. [08]

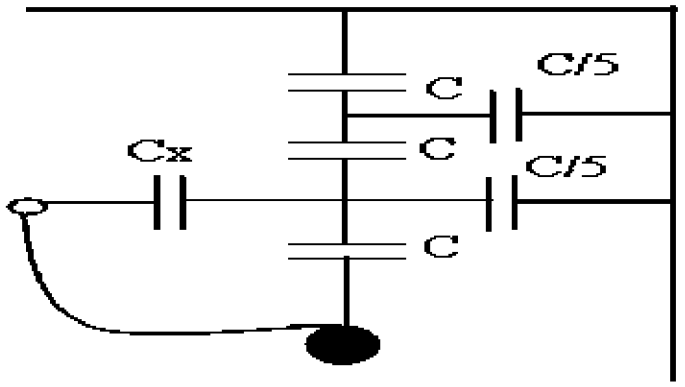
OR

Q.4) a. Discuss the necessity of excitation system used for alternators. Explain one of the types of excitation system used for alternators in brief. [08]

b. In a transmission line, each conductor is at 20 KV and supported by a string of 3-suspension insulators. The air capacitance between each cap-pin junction and tower is $1/5^{th}$ of the capacitance C of each insulator unit. A guard ring effectively only over the line end insulator unit is fitted so that the voltages on the two units nearest the line end are equal. [08]

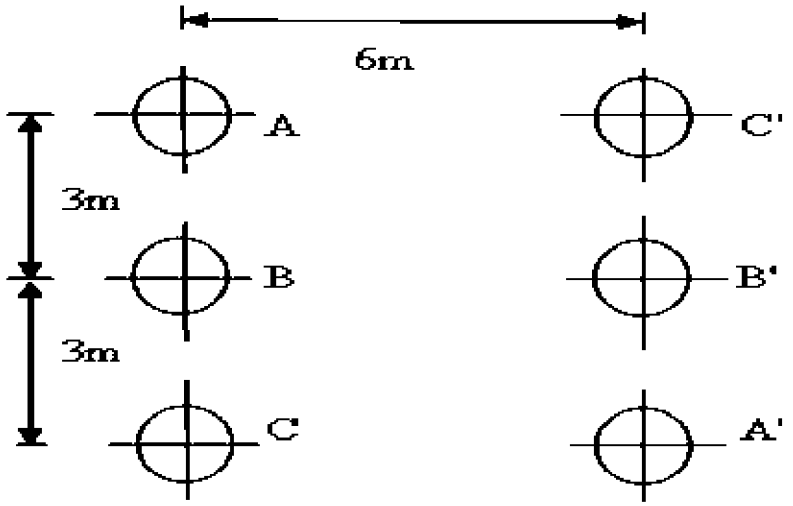
i) Calculate the voltage on the line end unit.

ii) Calculate the string efficiency.



Q.5) a. Derive an expression for the inductance of a three phase overhead transmission line when conductors are unsymmetrically spaced but transposed. [08]

b. Figure shows the spacing of a double circuit 3-phase overhead line. The phase sequence is ABC and the line is completely transposed. The conductor radius is 1.3 cm. Find the inductance per phase per kilometer. [08]



OR

Q.6) a. Derive the expression for internal and external flux linkages of a conductor carrying current I and thereafter derive the expression for inductance of a single phase line. [08]

b. A three phase 50Hz overhead transmission line consists of three conductors each of diameter 1.6 cm. The spacing between the conductors is as follows: A-B=4cm, B-C=9 cm, C-A=6cm. [08]

Find the inductance & inductive reactance per phase per km of the line

SECTION II

Q.7) A) Derive an expression for capacitance per phase of a three phase double circuit overhead transmission line with symmetrical spacing between conductors. [10]

B) A 50 Hz overhead transmission line consist of three conductors each of diameter 2cm and spaced 2.5m. calculate the capacitance per phase per km for the following arrangements between conductors. [08]

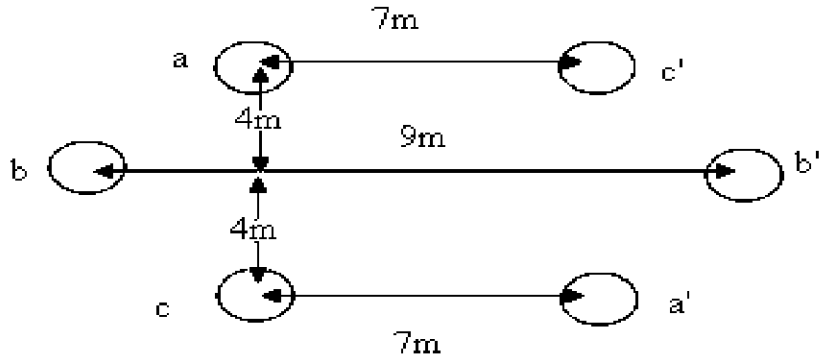
i) Equilateral Spacing ii) Horizontal Spacing with transposition.

OR

Q.8) A) What is the method of images? How can it be used to take into account [08]

the presence of ground in calculating the capacitance of a single phase line?

B) Determine the capacitance and charging current per phase per km for a 3 ph double circuit line as shown fig. The line operates at 132 kV and 50 Hz. The diameter of each conductor is 2.5 m. Assume that the line is completely transposed and neglect the effect of earth. [10]



Q.9) A) Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with Nominal 'T' method of representation. Evaluate the generalized circuit constants. Draw the phasor diagram. [09]

B) The following data refers to a 50 Hz, single phase transmission line: [07]

Length: 20km,

Load delivered at the receiving end: 4 MW at 0.80 p. f. lagging.

Resistance of each conductor: 0.025Ω/km., Inductance=0.7 mH/km

The voltage at the receiving end is required to be kept at 10kV. Find sending end voltage

OR

Q10) A) Derive the hyperbolic expression for sending end voltage and current in terms [10]

of receiving end voltage and current for a long transmission line.

B) Write a short note on Ferranti effect. [06]

Q11) A) Derive an expression for sag in case of overhead transmission line when the supports are at unequal level. Explain the meaning of every terms in the derivation [08]

B) A transmission line has a span of 150 m between level supports. The conductor has cross sectional area of 2 cm^2. The Tension in the conductor is 2000kg. The specific gravity of the conductor material is 9.9 gm/cm^3. If the wind pressure is 1.5 kg/m length of conductor. Calculate the sag. What is the vertical Sag? [08]

OR

Q12) A) Derive an expression for capacitance of a single core cable. [08]

B) Enlist the types of cable faults. What are the causes of failures of underground cables? Describe any one method of location of the cable fault. [08]